such subjects as plane trigonometry, variation and mensuration, etc., and with this in view I have premised the book by a simple statement of the methods of measuring angles, and the geometrical meanings of sine, cosine, etc., of an angle with simple explanation of the other operations." This might suffice to indicate the nature of the book, but it seems only fair to the public to give a few more specimens of the author's ideas. Naturally, we look to his chapters entitled 'Inertia and the Laws of Motion' and 'Energy and Work.'

In the former chapter, p. 83, we read, "From a large number of experiments we conclude that matter is incapable of changing its own state. This inert or passive condition is called the inertia of matter, and the law which regulates it is called the law of inertia." On p. 86, in reference to Maxwell's statement that "the change in momentum of a body is numerically equal to the impulse which produces it, and is in the same direction," the author remarks that "this law is sometimes called the law of impulse. We must be careful to distinguish between an impulse and impulsive force." Notwithstanding this caution, he says a few lines further on, "An impulse is a force which in a finite time produces a definite change of momentum." In the chapter on work and energy, p. 223, we are told "that there are many forms of energy, such as heat, light, chemical action, electricity, magnetism, etc. On this account the term mechanical energy is sometimes used to denote kinetic and potential energy." On p. 224, in explanation of a foot-poundal he tells us "this is sometimes called the absolute or kinetic unit of force. This unit," he adds, "was given by Newton, and it is probably the most accurate."

These illustrations, which might be easily multiplied to a wearisome extent, may serve to show the utterly chaotic character of the work in its treatment of fundamental principles. The author demonstrates clearly that if he has read the works of Maxwell, Thomson and Tait, etc., at all, he has read them to no purpose.

Mechanics (Dynamics). An Elementary Text-book, Theoretical and Practical, for Colleges and Schools. By R. T. GLAZEBROOK, M. A., F. R. S. Cambridge, at the University Press, New York, Macmillan & Co. 1895. Pp. xii. + 256.

This little book on dynamics is one of the 'Physical Series of the Cambridge Natural Science Manuals.' It is the outgrowth of the author's experience in giving a practical course of lectures and laboratory work in mechanics to students of medicine. The result is one of the best elementary books we have seen—one well worth reading, in fact, by those who have passed beyond the elements of the science. "Mechanics" the author says, in his preface, "is too often taught as a branch of pure mathematics. If the student can be led up to see in its fundamental principles a development of the consequences of measurements he has made himself, his interest in his work is at once aroused, he is taught to think about the physical meaning of the various steps he takes and not merely to employ certain rules and formulæ in order to solve a problem." This gives the key to the plan of the book, and so well is the plan executed that even the dullest reader cannot fail to get instruction if he comes to the subject without erroneous preconceptions.

The book is divided into eleven chapters, which are characterized throughout by clearness and precision of statement and aptness of illustration. The first chapter deals with units and methods of measurement and with the terms used in mechanics. Chapters II and III are devoted to kinematics, the first to velocity and the second to acceleration. Chapters IV and V treat of momentum and the time rate of change of momentum respectively. The term *force*, concerning which there is commonly enough obscurity even with mechanicians, and a sort of abysmal profundity with those philosophers who are not naturalists, appears in Chapter V as the name for the rate of change of momentum.

These first five chapters furnish what the author considers a sufficient inductive foundation for the science. Thenceforth he proceeds by deduction chiefly. Thus, at the close of the fifth chapter he says: "We are now about to make a fresh start and consider Dynamics as an abstract science based on certain laws or axioms which were first clearly enunciated by Newton and are called Newton's Laws of Motion. We

shall endeavor in the next chapter to explain these laws and to show how they may be illustrated by the simple cases of motion already discussed; we then go on to assume them as true always and to deduce their consequences in other cases." By way of proper caution he adds, however, that "We shall not now discuss the question whether these fundamental principles were stated in their best form by Newton. Our present object is to give a consistent account of the Science of Mechanics as it has been developed from Newton's laws."

The following chapters VI–VIII are devoted to the consideration of Newton's laws of motion and the consequences deducible therefrom. The presentation of these matters is admirable and must take rank with that given in the best works hitherto published. Indeed, though the book professes to be elementary only, its exposition of these matters appears to be as luminous and complete as can be given without the aid of the calculus.

The last three chapters deal with curvilinear motion of a particle under gravity, collision of masses, and motion of a particle in a circle respectively. The book has many well chosen illustrative examples, whose answers are given in most, though, properly, not in all cases. There are a few samples of examination questions given, and the book terminates with a good index.

The faults of the work, if any may be fairly urged against it, are faults of omission rather than of commission. The only one which seems worthy of mention is the absence of an explanation and a use of the theory of the dimensions of the units which figure in mechanical quantities. Nothing, we believe, helps more to fix ideas with regard to the terms force, momentum, energy, etc., in mechanics than a knowledge of that theory, while its application is of great aid to the student in detecting and in correcting his blunders. An application of this theory, for example, will immediately detect the misprint in the formula on p. 187 of the book; though it is but just to add that this is the only misprint which that theory has disclosed in our reading of the book. We may express the hope that future editions of this capital work will be improved by the addition of an appendix explaining the doctrine of units and dimensions of units in mechanical quantities and indicating the great utility of the doctrine to students and investigators.

R. S. WOODWARD.

Fourteenth Annual Report of the United States Geological Survey to the Secretary of the Interior, 1892–93. By J. W. POWELL, Director. Part I. Report of the Director. Part II. Geology—accompanying papers (Vignette). Washington, Government Printing Office. 1893. 8°, 2v.

Volume I., of 321 pages, is taken up by the administrative reports of heads of divisions and by other executive matters. The only general interest that it possesses lies in the fact that it sets forth the plans and policies of the Director and of the above officials. The second volume contains a valuable series of accompanying papers, viz:

1. Potable Waters of the Eastern United States, W J McGee, pp. 5–47.

2. Natural Mineral Waters of the United States, A. C. Peale, pp. 53–88.

3. Results of Stream Measurements, F. H. Newell, pp. 95–155.

4. The Laccolitic Mountain Groups of Colorado, Utah and Arizona, Whitman Cross, pp. 165–241.

5. The Gold-Silver Veins of Ophir, California, Waldemar Lindgren, pp. 249–284.

6. Geology of the Catoctin Belt, Arthur Keith, pp. 293–395.

7. Tertiary Revolution in the Topography of the Pacific Coast, J. S. Diller, pp. 403–434.

8. The Rocks of the Sierra Nevada, H. W. Turner, pp. 441–495.

9. Pre-Cambrian Igneous Rocks of the Unkar Terrane, Grand Canyon of the Colorado, Arizona, Charles D. Walcott, with notes on the Petrographic Character of the Lavas, by Joseph Paxson Iddings, pp. 503–525.

10. On the Structure of the Ridge between the Taconic and Green Mountain Ranges in Vermont, T. Nelson Dale, pp. 531–549.

11. On the Structure of Monument Mountain in Great Barrington, Mass., T. Nelson Dale, pp. 557–565.

12. The Potomac and Roaring Creek Coal